

## TITANIUM PARTS HAVING A BLASTED SURFACE TEXTURE

### CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] The present application is a divisional of U.S. patent application Ser. No. 16/584,692, entitled “TITANIUM PARTS HAVING A BLASTED SURFACE TEXTURE,” filed Sep. 26, 2019, which claims the benefit of U.S. Provisional Application No. 62/737,669, entitled “TEXTURED SURFACE FOR TITANIUM PARTS,” filed Sep. 27, 2018, the contents of which are incorporated herein by reference their entireties for all purposes.

### FIELD

[0002] The described embodiments relate generally to techniques for forming an etched titanium part. More particular, the described embodiments relate to systems and methods for restoring a gloss finish of the etched titanium part.

### BACKGROUND

[0003] Portable electronic devices can include various operational components (e.g., display, processor, antenna, etc.). Enclosures for these portable electronic devices can be formed of various metals (e.g., anodized aluminum, etc.) having a high amount of strength and stiffness to protect these operational components. Additionally, it is preferable to process these enclosures such as to impart these enclosures with an attractive surface finish. However, specific types of metals, although having a high amount of strength and stiffness, are also difficult to process to impart an attractive surface finish. Accordingly, there is a need to implement techniques for processing these specific types of metals.

### SUMMARY

[0004] This paper describes various embodiments that relate generally to techniques for etching a titanium part. More particularly, the described embodiments relate to systems and methods for restoring gloss finish of the etched titanium part.

[0005] According to some embodiments, an enclosure for a portable electronic device is described. The enclosure includes a titanium substrate having a textured surface having (i) an  $S_dq$  (root mean square gradient) that is greater than 0.2 micrometers, and (ii) a gloss value that is greater than 90 gloss units as measured at 60 degrees by a gloss meter.

[0006] According to some embodiments, an enclosure for a portable electronic device is described. The enclosure includes a titanium substrate including a textured surface having peaks separated by valleys, where apexes of the peaks are separated from troughs of the valleys by at least 2 micrometers, and the textured surface has a gloss value that is greater than 90 gloss units as measured at 60 degrees by a gloss meter.

[0007] According to some embodiments, an enclosure for a portable electronic device is described. The enclosure includes a titanium substrate including a textured surface having alternating peaks separated by valleys, where the textured surface is characterized as having an  $S_q$  (root mean square height) that is greater than 0.2 micrometers. The

enclosure further includes an anodized layer that overlays a portion of the textured surface.

[0008] This Summary is provided merely for purposes of summarizing some example embodiments so as to provide a basic understanding of some aspects of the subject matter described herein. Other aspects and advantages of the invention will become apparent from the following detailed description taken in conjunction with the accompanying drawings which illustrate, by way of example, the principles of the described embodiments. Accordingly, it will be appreciated that the above-described features are merely examples and should not be construed to narrow the scope or spirit of the subject matter described herein in any way. Other features, aspects, and advantages of the subject matter described herein will become apparent from the following Detailed Description, Figures, and Claims.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0009] The disclosure will be readily understood by the following detailed description in conjunction with the accompanying drawings, wherein like reference numerals designate like structural elements.

[0010] FIG. 1 illustrates perspective views of various devices having surfaces that may be processed using the techniques described herein, in accordance with some embodiments.

[0011] FIGS. 2A-2E illustrate cross-sectional views of a process for forming a texturized surface of a metal part, in accordance with some embodiments.

[0012] FIG. 3 illustrates a flowchart of a method for forming a texturized surface of a metal part, in accordance with some embodiments.

[0013] FIGS. 4A-4B illustrate exemplary images of views of metal parts, in accordance with some embodiments.

[0014] FIGS. 5A-5B illustrate exemplary electron microscope images of top views of metal parts and corresponding profile views, in accordance with some embodiments.

[0015] FIGS. 6A-6D illustrate exemplary images of views of metal parts, in accordance with some embodiments.

[0016] FIGS. 7A-7C illustrate exemplary images of views of metal parts indicating a relationship between processing time and extent of the texturized surface, in accordance with some embodiments.

[0017] FIG. 8 illustrates an exemplary image of a cross-sectional view of a textured metal part capable of imparting diffuse reflection of visible light, in accordance with some embodiments.

[0018] FIGS. 9A-9B illustrate exemplary cross-sectional views of welded metal parts having a non-textured surface and a textured surface, respectively, in accordance with some embodiments.

[0019] FIGS. 10A-10B illustrate exemplary views of a welded metal part having a textured surface, in accordance with some embodiments.

[0020] FIGS. 11A-11E illustrate cross-sectional views of a process for forming a metal part having a blasted surface, in accordance with some embodiments.

[0021] FIGS. 12A-12E illustrate cross-sectional views of a process for forming a metal part having an anodic layer, in accordance with some embodiments.

[0022] FIG. 13 illustrates a flowchart of a method for forming a metal part, in accordance with some embodiments.